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09/932,040	08/16/2001	Charles H. Dennison	M122-1676	4501

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EXAMINER	
ROCCHEGIANI, RENZO	
ART UNIT	**PAPER NUMBER**
2825	

DATE MAILED: 04/07/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/932,040	DENNISON	
	Examiner	Art Unit	
	Renzo N. Rocchegiani	2825	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 November 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-40* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-40* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 3, 5, 8, 10, and 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,081,021 (Gambino et al.)

Gambino et al. disclose forming an insulative mass across a first and second electrical nodes that comprise metals such as aluminum separated by dielectric material laterally adjacent thereto (Fig. 4, and col. 5, lines 15-20). The mass has a pair of opening to uncover the two nodes. (Fig. 5). A dielectric layer, such as silicon nitride about 5 to 200 nm thick (col. 5, lines 25-30), is formed in the opening so as to narrow the openings. (Fig. 6). Two conductive plugs are formed wherein one is in contact with one of the nodes while the other is separated from the node by way of the dielectric layer formed in the via. (Fig. 7-8). The conductive plugs comprise a metal such as aluminum or titanium or copper or tungsten and may comprise multilayer structures. (col. 5, lines 5-15). In patterning the dielectric layer that is deposited in the vias, Gambino et al. disclose the use of a mask. (col. 6, lines 35-42).

Gambino et al. do not disclose that the dielectric layer adjacent to the nodes is thinner than the nodes, yet Gambino et al. disclose that the nodes are interconnect structures. (col. 3, lines 40-45).

It would have been obvious to one with ordinary skill in the art to form the dielectric layer thinner than the node, since it is well known in the art that interconnect structures are comprised of multiple dielectric layers and since it has been held that constructing a formerly integral structure in various elements, i.e. multiple thinner layers as opposed to one thick layer of dielectric, involves only routine skill in the art. *Nerwin v. Erlichman*, 168 USPQ 177.

3. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,081,021 (Gambino et al.) in view of U.S. Patent No. 5,233,217 (Dixit et al.).

As stated in paragraph 2, all the limitations of the claims have been met except for teaching that the insulative mass comprises BPSG.

Dixit et al. teach the formation of an antifuse wherein the dielectric layer formed over the nodes is BPSG. (col. 3, lines 1-5).

It would have been obvious to one having ordinary skill in the art to use BPSG for the insulative mass, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

4. Claims 4 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,081,021 (Gambino et al.) in view of U.S. Patent No. 5,674,787 (Zhao et al.).

As stated in paragraph 2, all the limitations of the claims have been met except for teaching that the dielectric layer deposited in the vias is SiON and that the node comprises copper.

Zhao et al. teach the formation of plugs wherein the dielectric layer formed within the via is SiON and wherein the node comprises copper. (Abstract)

It would have been obvious to one having ordinary skill in the art to use SiON for the dielectric inside the via and copper for the node, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

5. Claims 6, 7, 12, 20 and 22-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,081,021 (Gambino et al.) in view of U.S. Patent No. 5,191,241 (McCollum et al.) and in further view of U.S. Patent No. 5,110,754 (Lowrey et al.).

As stated in paragraph 2, all the limitations of the claims have been met except for teaching that the nodes comprise n-type and p-type regions and that the plug is formed with polysilicon.

McCollum et al. teach the formation of an antifuse (item 336) in an integrated circuit wherein the nodes comprise source and drain regions doped in the substrate (items 314 and 316, and col. 6, lines 20-25).

Lowrey et al. teach the formation of an antifuse wherein the nodes comprise n-type and p-type regions (Fig. 13) and wherein the plug comprises a metal or polysilicon. (col. 4, lines 33-45).

It would have been obvious to one having ordinary skill in the art to have the node regions comprise n-type and p-type, since Gambino et al. discloses that the nodes

in its invention are interconnect structures, because McCollum teaches a very similar structure that Gambino et al. disclose except that it is more specific as to what the interconnect structure would be connected to, i.e. separate source and drain regions, and since Lowrey et al. teach what such source and drain regions are made of, i.e. n-type and p-type dopant, thus in light of the teachings of these three references one with ordinary skill in the art would recognize that these elements work together and thus would have an expectation of success in combining them.

6. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,081,021 (Gambino et al.) in view of in view of U.S. Patent No. 5,191,241 (McCollum et al.) and of U.S. Patent No. 5,110,754 (Lowrey et al.) and in further view of U.S. Patent No. 5,233,217 (Dixit et al.).

As stated in paragraph 6, all the limitations of the claims have been met except for teaching that the insulative mass comprises BPSG.

Dixit et al. teach the formation of an antifuse wherein the dielectric layer formed over the nodes is BPSG. (col. 3, lines 1-5).

It would have been obvious to one having ordinary skill in the art to use BPSG for the insulative mass, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

7. Claims 11 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,081,021 (Gambino et al.) in view of U.S. Patent No. 5,171,715 (Husher et al.).

As stated in paragraph 2, all the limitations of the claims have been met except for teaching that the node and the plug are a mixture of aluminum and copper.

Husher et al. teach the formation of an antifuse wherein the node and the plug are a mixture of aluminum and copper. (col. 5, lines 1-9 and col. 7, lines 1-9).

It would have been obvious to one having ordinary skill in the art to form the node and plugs of a mixture of aluminum and copper, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

8. Claims 18-19, 24-28, 31, 33, and 36-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,081,021 (Gambino et al.) in view of U.S. Patent No. 6,087,677 (Wu).

As stated in paragraph 2, all the limitations of the claims have been met except for specifying that the plug comprises TiN and W.

Wu teaches an antifuse wherein the plug may comprise TiN and W. (col. 1, lines 45-50).

It would have been obvious to one with ordinary skill in the specific art to combine the teachings of Wu to those of Gambino, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

9. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,081,021 (Gambino et al.) in view of U.S. Patent No. 6,087,677 (Wu) and in further view of U.S. Patent No. 5,674,787 (Zhao et al.).

As stated in paragraph 8, all the limitations of the claims have been met except for teaching that the dielectric layer deposited in the vias is SiON and that the node comprises copper.

Zhao et al. teach the formation of plugs wherein the dielectric layer formed within the via is SiON and wherein the node comprises copper. (Abstract)

It would have been obvious to one having ordinary skill in the art to use SiON for the dielectric inside the via and copper for the node, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

10. Claims 29, 30 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,081,021 (Gambino et al.) in view of U.S. Patent No. 6,087,677 (Wu) and in further view of U.S. Patent No. 5,191,241 (McCollum et al.) and in further view of U.S. Patent No. 5,110,754 (Lowrey et al.).

As stated in paragraph 8, all the limitations of the claims have been met except for teaching that the nodes comprise n-type and p-type regions and that the plug is formed with polysilicon.

McCollum et al. teach the formation of an antifuse (item 336) in an integrated circuit wherein the nodes comprise source and drain regions doped in the substrate (items 314 and 316, and col. 6, lines 20-25).

Lowrey et al. teach the formation of an antifuse wherein the nodes comprise n-type and p-type regions (Fig. 13) and wherein the plug comprises a metal or polysilicon. (col. 4, lines 33-45).

It would have been obvious to one having ordinary skill in the art to have the node regions comprise n-type and p-type, since Gambino et al. discloses that the nodes in its invention are interconnect structures, because McCollum teaches a very similar structure that Gambino et al. disclose except that it is more specific as to what the interconnect structure would be connected to, i.e. separate source and drain regions, and since Lowrey et al. teach what such source and drain regions are made of, i.e. n-type and p-type dopant, thus in light of the teachings of these three references one with ordinary skill in the art would recognize that these elements work together and thus would have an expectation of success in combining them.

11. Claims 34 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,081,021 (Gambino et al.) in view of U.S. Patent No. 6,087,677 (Wu) and in further view of U.S. Patent No. 5,171,715 (Husher et al.).

As stated in paragraph 8, all the limitations of the claims have been met except for teaching that the node and the plug are a mixture of aluminum and copper.

Husher et al. teach the formation of an antifuse wherein the node and the plug are a mixture of aluminum and copper. (col. 5, lines 1-9 and col. 7, lines 1-9).

It would have been obvious to one having ordinary skill in the art to form the node and plugs of a mixture of aluminum and copper, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Response to Arguments

12. Applicant's arguments filed November 25, 2003 have been fully considered but they are not persuasive. Applicant presents that the claims as amended are not anticipated nor rendered obvious by the prior art. The examiner disagrees. In the specification of the pending application applicant has defined "substrate" and "substrate structure" to mean a base substrate that may comprise a number of layers and structures thereon. Thus, importing this meaning into the terms used in the claims the examiner reasonable interprets the node to comprise an interconnect structure that connects to a doped region found in the base substrate. With this interpretation and the addition of McCollum the claims are rendered obvious because McCollum teaches a basic interconnect structure with the similar features of Gambino and because Gambino expressly states that the nodes used therein are interconnect structures. Also, because interconnect structures typically comprise multiple layers, as evidenced by McCollum, it would be obvious to also form multiple layers of dielectric material. Thus, the added limitation of having "at least a dielectric" that is thinner than the node would be obvious to one with ordinary skill in the specific art because it does not limit the claim to a method of forming a structure any different from the one Gambino discloses. The limitation only requires that instead of one thick layer of dielectric material that two or

more thinner layers be formed. Applicant has not presented any evidence that would show that such variation would result in any benefit over the prior art, thus such limitation is obvious as been a mere transmutation of one layer into two or more layers. Because the rejection stands as previously presented, aside for the clarification made with the addition of McCollum to show why Lowrey may be combined with Gambino to render the claims obvious, this action is made final.

Conclusion

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Renzo N. Rocchegiani whose telephone number is 571-272-1904. The examiner can normally be reached on Mon.-Fri. 8:00 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Renzo N. Rocchegiani
Examiner
Art Unit 2825

MATTHEW SMITH
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